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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/559,142

12/01/2005

Moon-kyoon Chun

NEK-0015

9045

23413 7590 06/09/2008

CANTOR COLBURN, LLP

20 Church Street

22nd Floor

Hartford, CT 06103

EXAMINER

LISTVOYB, GREGORY

ART UNIT

PAPER NUMBER

1796

MAIL DATE

DELIVERY MODE

06/09/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/559,142	<b>Applicant(s)</b> CHUN ET AL.	
	<b>Examiner</b> GREGORY LISTVOYB	<b>Art Unit</b> 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 May 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11-19, 21, 23 and 24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-19, 21, 23 and 24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/9/2008 has been entered.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 5-8, 12-13, and 23-24 rejected under 35 U.S.C. 103(a) as being unpatentable over Oshida et al (JP publication 06-056921) herein Oshida in combination with Kurokawa (JP publication 2001-329021), herein Kurokawa.

Oshida discloses a method for manufacturing imide-substituted polymer comprising the following steps:

1. Reaction of 60-90%wt of aromatic vinyl monomer (for example, Styrene, lines 0007 and 0009) and 10-40 % wt of unsaturated dicarboxylic anhydride (for instance,

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maleic, line 0009, meeting newly added limitation of Claim 1) in methyl ethyl ketone at the presence of 0.011% wt initiator (line 0021) at 150C.

Regarding newly added limitation of Claim 1, Oshida discloses that the feeding ratio between vinyl and carboxylic acid monomers is less than 5:1 (see line 0021) based on their weight. Considering that MW of the monomers (MW of Maleic Anhydride is 98, MW of Styrene is 104 and MW of Methylmethacrylate is 102) are close, the corresponding molar ratio is less than 6:1, meeting the newly added limitation of Claim 1.

2. Separation step performed by supplying the polymerized solution discharged from the step (1) into a separator and then removing unreacted monomers and solvent at 200C and 50 Torr (line 0022).

3. Reaction of continuously supplying melt from step (2) into imidization reactor, containing Aniline (line0023)

4. Drying step to remove volatiles.

In reference to a newly added limitation about total residence time of 2-5 hours, Oshida and the Application disclose the same imidization reaction. However, since Oshida discloses a continuous process, compare to The Application's batch one, Oshida does not disclose a residence time of a reaction.

The advantage of batch reaction is that it allows to achieve higher yield. Also, an artisan can choose batch reactor for economical reasons, especially if limited amount of product intended to be produced. Another advantage of the batch process is that it does not require expensive equipment

Therefore, It would have been obvious to a person of ordinary skills of the art to establish a batch process with reaction time to achieve predetermined conversion of the monomer due to higher yield and in order to make a process more economically attractive.

In reference to Claim 24, Oshida discloses weight average molecular weight of 135000 (see Table 1). Note that not Applicant nor Oshida disclose proper determination of MW by GPC, since GPC is a relative method and GPC standards are not disclosed (see Spec page 31 and Oshida line 0033). By using PS standards with one detector only relative MW numbers can be obtained. Considering the above arguments and the fact that typically MW numbers obtained in different labs differ by up to 20%, MW of 135000 (Oshida) and 140700 (Application) are indistinguishable for an artisan.

Oshida does not teach that imidization reaction (step 3) takes place at the presence of catalyst.

Kurokawa discloses a multi step method for production of imidized polymer, where imidization step takes place in Methylisobutyl ketone at the presence of triethylamine (Example 1). The catalyst increases the rate of imidization

Therefore, it would have been obvious to a person of ordinary skills in the art to use a solvent and a catalyst in imidization, since catalyst increases the rate of imidization.

Oshida does not teach conversion of unsaturated carboxylic acid is 95% or more  
Kurokawa teaches that conversion of unsaturated carboxylic acid is 95% or more (Line 005).

Kurokawa teaches that non-polymerised monomer imidizes, degrading the color of the product and therefore, its organoleptic quality.

Therefore, it would have been obvious to a person of ordinary skills in the art to achieve high conversion of the unsaturated carboxylic acid in order to achieve high quality of the copolymer.

Oshida and Kurokawa do not teach the amount of homopolystyrene.

Kurokawa teaches that MWD of the final polymer is between 2 and 3, which is close to theoretical MWD. It suggests that the polymer is unimodal styrene-maleinate

copolymer. In contrast, in case of forming vinyl-based homopolymer, the resulting MWD would be significantly broader than 3.0.

In addition, Specification of the Application discloses the following: "A reaction temperature in the copolymerization step ranges from 80 to 150 °C, and more preferably 90 to 130 °C. If the temperature is lower than 80 °C, it may not be possible to secure a desired conversion and if it exceeds 150 °C, it may not be possible to obtain the desired molecular weight and a relatively large amount of aromatic vinyl homopolymers, particularly polystyrene, may be generated".

In his Examples Kurokawa performs a polymerisation at 85C, which is in the lower end of the polymerization temperature disclosed in the Specification. Thus, Kurokawa's polymerization conditions do not favor homopolymer formation.

Therefore, it would have been obvious to a person of ordinary skills in the art that with reasonable degree of expectation Kurokawa's polymer has the amount of homopolystyrene at level or lower than one of the Application.

Claims 1, 4, 9, 11 and 14-19, 21, 23 rejected under 35 U.S.C. 103(a) as being unpatentable over Kurokawa in combination with Oshida.

Kurokawa discloses a multi step method for production of imidized polymer, where imidization step takes place in Methylisobutyl ketone at the presence of triethylamine (Example 1).

Kurokawa does not teach the amount of homopolystyrene.

Kurokawa teaches that MWD of the final polymer is between 2 and 3, which is close to theoretical MWD. It suggests that the polymer is unimodal styrene-maleinate copolymer. In contrast, in case of forming vinyl-based homopolymer, the resulting MWD would be significantly broader than 3.0.

In addition, Specification of the Application discloses the following: "A reaction temperature in the copolymerization step ranges from 80 to 150 °C, and more preferably 90 to 130 °C. If the temperature is lower than 80 °C, it may not be possible to secure a desired conversion and if it exceeds 150 °C, it may not be possible to obtain the desired molecular weight and a relatively large amount of aromatic vinyl homopolymers, particularly polystyrene, may be generated".

Therefore, it would have been obvious to a person of ordinary skills in the art that with reasonable degree of expectation Kurokawa's polymer have the amount of homopolystyrene at level or lower than one of the Application.



Regarding claim 4, Kurokawa discloses 0.001-1%wt of initiator, which is of 1,1 bis (tert-butyl-peroxy) cyclohexane (see line 0013).

Regarding Claim 9, Kurokawa teaches 60 % wt of Metylisobutyl ketone in the first reaction step.

In reference to claim 11, reaction temperature in the reactor gradually increases from 85 to 140C (Example 1).

In reference to Claim 14, Kurokawa teaches that the molar ratio between maleic anhydride and aniline is within the range of 0.1-0.9 (Example 1).

In reference to claims 15 and 16, Kurokawa teaches that the ratio of triethylamine to aniline is 3/97 (Example 1).

Regarding claim 18 and 19, Kurokawa teaches that imidization takes place at 140C (Example 1) and devolatilization occurs at 310C and 30 torr (Example 1).

Kurokawa does not teach the amount of homopolystyrene.

In his Examples Kurokawa uses reaction temperature of 85C, greatly reducing possibility of polystyrene formation.

In reference to claim 21, since the Kurokawa's reaction conditions are analogous to one in the application, Kurokawa's process completes at the same time as one in the Application (see discussion above).

Kurokawa does not teach a separation step between polymerization and imidization.

Therefore, it would have been obvious to a person of ordinary skills in the art that with reasonable degree of expectation Kurokawa's polymer have the amount of homopolystyrene at level or lower than one of the Application.

Oshida teaches the above separation step. Separation of unreacted monomer and solvent is economically beneficial, since they can be returned into the first step of the process without any additional separation.

Therefore, it would have been obvious to a person of ordinary skills in the art to include a separation step between polymerization in Kurokawa's process, since it provides economically sound process due to recycling unreacted monomer and solvent.

### ***Response to Arguments***

Applicant's arguments filed on /09/2008 have been fully considered but they are not persuasive.

Applicants disagree with the Examiner's basis of rejection as set forth in the Advisory Action. The Examiner has stated in the Advisory Action dated April 24, 2008 that "the presence of homopolymer inevitably leads to broadening MWD".

The Examiner agrees that “inevitably” is not a proper word in this context. In the present Rejection this word replaced by “most likely”.

Specification of the Application discloses the following: “A reaction temperature in the copolymerization step ranges from 80 to 150 °C, and more preferably 90 to 130 °C. If the temperature is lower than 80 °C, it may not be possible to secure a desired conversion and if it exceeds 150 °C, it may not be possible to obtain the desired molecular weight and a relatively large amount of aromatic vinyl homopolymers, particularly polystyrene, may be generated”.

Thus, since Kurokawa in his Examples uses reaction temperature of 85C, possibility of polystyrene formation is greatly reduced, compare to a process of the Application examined, where polymerization temperature is 100C (see Examples).

Applicant argues that amount of homopolystyrene is achieved by low residence time of 2-5 hours.

As cited before, Specification discloses reaction temperature of 80-150C. It is clear that reaction rate increases with temperature. Therefore, it would have been obvious to a person of ordinary skills in the art to adjust this technological parameter in order to achieve economically sound process with product of desired quality.

The Applicant states that neither Oshida nor Kurokawa discloses this ratio of monomers necessary to prevent the formation of polystyrenes. This is incorrect. Maleic anhydride monomer is supplied with rate of 0.4 kg/Hr and styrene-containing mixture is supplied with rate of 2 kg/Hr (see Oshida, 0021). Therefore, the Styrene/Maleic Anhydride ratio can be easily calculated.

Examiner has never stated that Oshida discloses unsaturated carboxylic monomer conversion of 95%. However, Kurokawa teaches this conversion (see Kurokawa, line 005). Kurokawa teaches that non-polymerised monomer imidizes, degrading the color of the product and therefore, its organoleptic quality.

Therefore, it would have been obvious to a person of ordinary skills in the art to achieve high conversion of the unsaturated carboxylic acid in order to achieve high quality of the copolymer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GREGORY LISTVOYB whose telephone number is (571)272-6105. The examiner can normally be reached on 10am-7pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vasu Jagannathan can be reached on 571-272-1119. The fax phone

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number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rabon Sergent/  
Primary Examiner, Art Unit 1796

GL

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